SOME ECONOMIC AND SOCIAL IMPLICATIONS OF THE SOIL AND WATER CONSERVATION PROGRAM IN THE LITTLE MILL CREEK WATERSHED, COSHOCTON COUNTY, OHIO

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Introduction

The purpose of this study is to inquire into the economic and social implications of the soil and water conservation program recommended by the Soil Conservation Service for the Little Mill Creek Watershed in Coshocton County, Ohio. Consideration will be given to the differences between the prevailing and recommended methods of farming, the probable cost of adopting the conservation practices, and the probable influence of the soil and water conservation program on the farm income and family living.

Although the broader aspects of erosion and erosion control have been recognized for a number of years, few farmers have adopted the most effective erosion control practices. This situation was probably due to an abundance of rich agricultural land, and to the following of established customs in farming. To the pioneer farmer land was an unlimited factor in agricultural production as long as the cultivated area could be increased by clearing the forests. In the past the prevailing farm practice was to raise cultivated crops on the cleared land until the yields declined to the point where production was unprofitable. As the land eroded and declined in productivity it was either abandoned or left to "rest" and new land was cleared for crop production.

The use of modern farm machinery and the adoption of rectangular fields on sloping land have not always been conducive to soil conservation.

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The practice of planting an entire slope to one crop and not following contour cultivation has resulted in large soil and water losses. In many cases farmers on rough land have attempted to follow practices adapted only to level land. Thus, if the productivity of the soil on steep slopes is to be maintained soil conservation practices must be followed.

Method of Study

Any attempt to answer the question of the economic feasibility of a soil and water conservation program based on a statistical analysis of farms operated in this manner will require a period of years. This is due to the fact that the complete returns from lime and fertilizer are not realized immediately after application, and in many cases several years must elapse before any increases in the yields of grain will result from the plowing under of larger crop residues.

At the present time a statistical study is being made of the economic advantages and limitations of the recommended soil and water conservation practices for the Little Mill Creek Watershed. Surveys of the economic and social conditions on 42 farms were made in 1935, 1936 and 1937 for the purpose of establishing a base for the future evaluation of the recommended conservation program. In 1938 a group of farmers previously interviewed in the area signed cooperative agreements with the Soil Conservation Service and agreed to put into operation the conservation practices stated in the agreements. On these cooperating farms, records have been kept in order to measure some of the economic effects of the new farm practices.

Briefly the soil and water conservation program for the Little Mill Creek area includes the proper adjustment of land use, the adoption of strip cropping and contour cultivation on steep slopes, the improvement

of the meadows and pastures, and the reforestation of areas unsuitable for cropping or pasture. The Soil Conservation Service has agreed to furnish technical assistance in replanning the farms, enough lime for the production of an alfalfa-clover-timothy hay mixture on all of the rotated land, and also sufficient lime for the improvement of the permanent pasture.

This report is an appraisal of some of the expected results of the recommended soil and water conservation program based on the research material that is now available on the Little Mill Creek Area and in related fields. It is not intended to represent the final analysis of the results of the recommended program since such an analysis cannot be made until data have been collected for a number of years on the farms following the new practices.

Description of the Agriculture of the Area

Location and Soil Types. The area studied is located in east-central Ohio in the northeastern corner of Coshocton County and comprises approximately 5000 acres of land designated by the Soil Conservation Service as "Little Mill Creek Watershed". This area lies in portions of Mill Creek, Crawford and Keene Townships which were organized in 1817, 1824 and 1828, respectively. The topography is hilly with several narrow strips of bottom land occurring in the watershed. Practically all of the cultivated land is on slopes that are subject to erosion unless proper control methods are used.

The soil types are Muskingum and the related series which are sometimes inadequately drained. The area is unglaciated and is underlain with sandstone, shale, and occasionally small deposits of limestone. The soil is acid in reaction except where lime has been applied recently.

Originally, the land was covered by hardwood forests, and as late as 1835 unsettled land was still reported in Crawford Township. After the land was first cleared it produced only fair yields of corn and other crops due to the moderate level of natural soil fertility and content of organic matter. As the supply of organic matter in the soil diminished a highly erodible condition developed especially on the steeper slopes. Although much of the land in the area has been farmed less than 100 years approximately one-half to three-fourths of the original topsoil has been lost as a result of erosion. The area is roughly representative of large portions of eastern and southeastern Ohio.

Land Use. The 42 farms ranged in size from 32 to 372 acres with an average of approximately 124 acres of which 46 per cent was in rotated crops; 22 per cent was in permanent pasture and 22 per cent was in forest. Approximately one-third of the farms were in the 80 acre group and one-fourth were in the 160 acre group. The rotated land included the farm area in cultivated crops, hay, rotation pasture, and land in the rotation that produced no harvestable crop in 1937. A small amount of steep land that was not pastured in 1937 was reported as idle.

The land use pattern in table I is quite different from the pattern of 100 years ago. At the close of the War of 1812, Coshocton County claimed only 138 resident land owners. At that time the land was largely covered with a mixed stand of hardwoods consisting of chestnut, walnut, beech, maple, hickory, and oak. Within the following fifty years many of the forests were cleared until less than one-third of the area was covered by trees in 1880. From 1880 to 1935 the acreage in forest declined approximately 40 per cent in Crawford, Keene, and Mill Creek Townships.

Table I. Land Use in 1937 on 42 Farms in the Little Mill Creek Watershed

Land Use	Acreage		Per cent of total farm area
	Total	Average per farm	
Rotated area	2419	57	46
Woods	1167	28	22
Permanent pasture	1131	27	22
Orchard	27	1	1
Idle land	181	4	3
Roads, buildings, waste	287	7	6
Total farm area	5212	124	100

It is impossible to state definitely how the cleared land was used, but it is reasonable to assume that cultivated crops were raised on the recently cleared land and older farmed areas were converted to meadow and permanent pasture. This assumption is based on the census data which show only a small increase in the acreage of grain crops from 1880 to 1935, and is in line with the present farm practice of raising the grain crops on the most productive land.

A six-year rotation was followed on most farms in 1937, and consisted of corn, oats, wheat, and either hay for three years or two years of hay and one year of rotation pasture. The tendency has been to discontinue the raising of oats due to low yields. In 1937 several of the farmers were raising alfalfa, but the principal hay crop was timothy, the acreage of the latter being approximately twice as large as the acreage of clover. See table II. A small amount of clover seed was usually produced for use on the farm.

The total area devoted to cereal crops in Coshocton County was greatest during the eighteen fifties. During the period 1879 to 1934 an 8 per cent decrease in the acreage of grain crops, and a 26 per cent

Table II. Use of the Rotated Area in 1937 on 42 Farms in the Little Mill Creek Watershed

	Acreage		Per cent of rotated area
	Total	Average per farm	
Corn	380	9.1	16
Oats	198	4.7	8
Wheat and rye	367	8.7	15
Soybean hay	26	.6	1
Truck	6	.1	-
Total depleting crops	977	23.2	40
Clover hay	131	3.1	6
Clover-timothy hay	200	4.8	8
Timothy hay	519	12.4	22
Alfalfa hay	29	.7	1
Rotation pasture	345	8.2	14
Timothy seed	67	1.6	3
Idle land	151	3.6	6
Total	2419	57.6	100

increase in the acreage of hay occurred in Crawford, Keene and Mill Creek Townships. During this fifty-five year period the corn acreage for the three townships decreased from 1074 acres in 1879 to 1059 acres in 1934; the oats acreage decreased from 751 to 621 acres; the wheat acreage decreased from 1245 to 1109 acres; and the hay acreage increased from 1785 to 2250 acres. Since the Little Mill Creek area is assumed to be representative of the three townships, approximately the same percentage change in crop production may be assumed for this area.

Crop Yields. Table III shows that the corn and oats yields for the Little Mill Creek area are slightly lower than the average yields for Coshocton County. This difference is due to the fact that the latter area is composed of a higher percentage of land in river and creek valleys. The crop yields on the former area are representative of the yields on the Muskingum and related soil series.

Table III. Crop Yields per Acre in the Little Mill Creek Watershed and Coshocton County 1935-37

Crop	Little Mill Creek(a)			Coshocton County(b)		
	1935	1936	1937	1935	1936	1937
	bu.	bu.	bu.	bu.	bu.	bu.
Corn	29	36	33	39	39	42
Oats	22	25	27	33	30	26
Wheat	20	18	19	19	15	17

(a) 1935, average yield on 42 farms; 1936 and 1937, average yield on 36 farms.
(b) Data compiled by U.S. Dept. of Agr. and Ohio Agr. Expt. Sta.

The census data for Coshocton County showed no marked increase in crop yields during the last seventy-five years, although a number of improved agricultural practices have been adopted by many of the farmers. In 1936 the farmers in the Little Mill Creek area applied, on the average, 125 pounds of fertilizer per acre on corn, 140 pounds per acre on oats, and 175 pounds per acre on wheat. Approximately $\frac{1}{2}$ ton of ground limestone per acre was applied once during the rotation. The natural productivity of the soil has been declining at a rate that has approximately offset all increases in yields due to the application of fertilizer and lime, the use of improved varieties of crops, the control of insects and diseases, and the retirement of poor land to permanent pasture. Soil erosion, which has caused a loss of approximately one-half to three-fourths of the topsoil in the area, has been one of the chief factors contributing to the depletion of the fertility of the soil.

Livestock. Table IV shows that the chief classes of livestock on the farms are dairy and beef cattle, poultry, and sheep. The dairy herds consist of Jerseys, Guernseys and Holsteins, Jerseys being the predominant breed. The usual practice among the sheep producers is to maintain a fine-wool flock, but on several farms fine-wool ewes are crossed with coarse-wool rams. During recent years large losses in the sheep enter-

prise have occurred from internal parasites. Since the topography of the area is rough, it is better adapted to the production of hay and pasture than grain. Therefore, the most desirable combination of livestock for this area is one that includes a high percentage of hay consuming animals.

Table IV. Average Livestock Numbers per Farm on 42 Farms in the Little Mill Creek Watershed, 1937

Class	Average number of head per farm
Cows milked	5.7
Beef cows	1.0
Horses	2.5
Ewes	19.0
Sows	1.0
Hens	96.0

A decline in the number of all classes of livestock occurred in Coshocton County during the period 1850 to 1930. The number of horses declined approximately 35 per cent. The number of sheep reached the peak in 1860-70 and then declined approximately 50 per cent in 1930. During the eighty-year period the number of hogs declined 60 per cent, and the number of cattle 10 per cent. These changes in livestock production were probably associated with a shift from beef to dairy cattle, losses in the sheep enterprise due to internal parasites, an increase in the amount of poultry, and the decline in the carrying capacity of the pastures.

Land Tenure. In 1937 all farms in the area were either operated by owners or related tenants. Table V shows that the tendency has been to keep the ownership of the farms in the same family, some being owned by the same family for approximately 100 years. In many cases the ownership has changed only when a son acquired title to the land. In general the farming unit included only land owned by the operator, and only occasionally a field was rented from a neighbor.

Table V. Length of Time 38 Little Mill Creek Farms Have Been in the Same Family

Years	Number of farms
0-24	12
25-49	11
50-74	9
75-99	6

The extremely high percentage of farm ownership is probably due to the fact that the Little Mill Creek area is not adapted to a tenant system of farming. The majority of the farms are too small to produce a satisfactory income for a landlord and a tenant; satisfactory leases are difficult to make on farms where a livestock type of farming is followed; and the rolling land is unsuitable for tenant farming since every precaution must be taken to control erosion.

Labor Income. The average labor income for the Little Mill Creek farms was $618 for 1936 and $370 for 1937. These figures include all gross farm and miscellaneous receipts, minus farm expenses, plus or minus a change in the inventory of crops and livestock, minus an interest charge on the capital invested. In calculating the labor income no account was taken of the value of the products produced and consumed on the farm, or the rental value of the farm dwelling. The labor incomes ranged from a loss on some farms to over $1000 on the most profitable farms. The reduction in labor income from 1936 to 1937 was due to decreases in the value of inventories as a result of declining farm prices rather than a curtailment of farm operations.

The farms are all of the general livestock type and are located within an area of approximately fifteen square miles. In 1937 the amount of capital invested in the average farm was $5200. This investment

included the value of the land, buildings, fences, livestock, and feed on hand January 1, 1937. The average gross receipts were $1240 and the average cash expenses $543. The sources of income were as follows: livestock and livestock products, 83 per cent; crops, 8 per cent; and miscellaneous, 9 per cent. The receipts from cattle and poultry constituted over one-half of the entire gross receipts. Fifty-seven per cent of the total receipts from both dairy and beef cattle was from butter, cream, and market milk, the latter constituting nearly three-fifths of the dairy product sales.

A study of the factors that contributed to labor income showed the importance of size of farm, volume of business, crop yields, soil conservation, and efficiency in crop and livestock production. The correlation between these factors and labor income has been discussed in many farm management studies in the past; therefore, only the influence of soil conservation will be considered at this time. Since soil conservation is only one of the many contributing factors to labor income, it is difficult to measure its influence accurately from farm management records alone because none of the factors can be isolated and studied independently. A study of the crop yields, however, showed that they were associated with such conservation factors as the type of hay and the amount of manure, lime and fertilizer applied. In general all farms in the area had approximately the same percentage of conserving crops in the rotation; however, there was a great difference in the type of hay and pasture. The effects of soil conservation are cumulative up to a certain point. As yields are improved more feed is available; thus, more livestock can be kept, and more manure will be available for maintaining or further increasing the fertility of the soil.

The Problem of Soil Conservation in the Area

During the last 75 years one-half to three-fourths of the original topsoil has been lost on some of the farms due to erosion. If this rapid loss of soil continues in the future, how will the farmer be affected economically and socially? Will he be able to maintain the productivity of the soil, or will crop yields eventually decline to the point where the land must be abandoned? On some farms where severe sheet erosion has already occurred the tendency will be to retire some of the rotated land to permanent pasture if erosion continues in the future. Such changes in land use will occur after crop production has become unprofitable due to low yields. Under the prevailing system of pasture management the carrying capacity will continue to decline. No fertilizer or lime and only a small amount of manure will be applied. Over-grazing the pasture will further reduce the stand of grass with the result that erosion will continue and the formation of gullies will lead ultimately to the abandonment of the land.

On farms where erosion losses have been small crop yields will tend to decline slowly, if the present farming practices are continued. Thus, the land in this group of farms could be used for a number of years before crop yields would decline to the point where agriculture will be unprofitable. It is impossible to state accurately the effects of soil erosion upon labor income in the future. Technological improvements in agricultural production may tend to balance reductions in income as a result of declining yields due to soil erosion. However, such improvements should not be substituted for the conservation of the soil.

The ultimate objective of any soil conservation program is the most efficient present and future utilization of the soil resources from

the standpoint of the welfare of the individual and society in general. This will include a system of farm management that will tend to maintain the productive capacity of the soil over a period of years, and yet be economically feasible for the farmer to follow. Such a system of farm management would reduce the loss of soil particles, organic matter, water, and mineral elements that are necessary for plant growth.

The Soil Conservation Program for the Area

The following section of this report will be devoted to a discussion of the proposed changes in farm organization and some of the probable economic and social effects of following the recommended soil and water conservation practices. Attention will be focused on the group of farmers who signed cooperative agreements with the Soil Conservation Service in 1938.

Changes in farm organization are recommended by the Soil Conservation Service for the purpose of reducing soil and water losses by methods that are economically feasible for the farmer to follow. At the present time, some of the more successful farmers are following a land-use program similar to the one recommended by the Soil Conservation Service. On the other hand, some of the farmers are following a system of land use that is rapidly depleting the soil. On rolling land, an effective method of erosion control is to have all of the land in permanent pasture or forest. However, such a land-use program would materially reduce the income of the farmer. Therefore, in planning a soil conservation program for a particular farm the human and economic factors as well as the physical factors should be considered.

Soil and water losses are affected by (1) the amount and intensity of the rainfall, (2) length and steepness of the slope, (3) type of soil, and (4) type of vegetative cover. Recommendations for the reduction of soil and water losses in the Little Mill Creek area include contour tillage, strip cropping, buffer strips, sod waterways, the reduction of the acreage of depleting crops, the improvement of the meadows and permanent pasture and reforestation. The choice of a soil-conserving practice, or a combination of such practices for any specific field or farm must be determined by the combination of erosion-producing factors present in that particular case.

General Land Use Recommendations. Table VI gives the general land-use recommendations as outlined by the Soil Conservation Service. Land with a slope of less than 5 per cent will be used for crops and in a few cases permanent pasture. The permanent pasture land on such slopes will include only bottom land subject to overflow. The conservation methods will include good farming practices such as the application of lime, fertilizer and manure and proper crop rotations. No mechanical methods will be used to control erosion.

On 5 per cent to 11 per cent slopes a rotation of not less than four years, two of which may be depleting crops, is recommended. Contour strip cropping will be used and the strips will not exceed 100 feet in width. Eroded land with occasional gullies will be converted to forest. The present forest land will remain in forest.

On 12 per cent to 19 per cent slopes a rotation of not less than four years, of which no more than two years may be depleting crops, will be followed. Strip cropping will be practiced with strips varying from 42 feet to 70 feet, the narrow strips being on the steeper slopes.

Severely sheet-eroded land will be converted to permanent pasture and severely eroded land with gullies will be reforested.

Table VI. General Land-Use Recommendations for the Little Mill Creek Watershed

Slope class		Recommended land use
A	0% - 4%	Good farming practices.
B	5% - 11%	Adapted for rotation land provided proper erosion-control measures are used.
BB	12% - 19%	Adapted to rotations without corn provided proper erosion-control measures are used.
C	20% - 29%	Adapted to permanent grass.
D	30% and over	Potential forest land.

Slopes 20 per cent to 29 per cent will be converted to permanent pasture. Severely eroded land that is gullied will be reforested. Slopes over 30 per cent will be reforested because this land is too steep to use farm machinery for applying lime and fertilizer.

Hay Improvement Program. Table VII shows that in 1937 approximately 70 per cent of the acreage of hay was timothy; 26 per cent was clover and clover-timothy mixture; 2 per cent was soybean; and 2 per cent alfalfa hay. The percentage of legume hay in 1937 was probably below the average due to the drought in 1936. The prevailing rotation of corn, oats, wheat, and three years of hay produced a large proportion of timothy hay.

The plans for the improvement of the type of hay include liming the crop land to the point where it will grow an alfalfa-clover-timothy mixture. This will require an initial application of approximately 2 to 3 tons per acre of ground limestone followed by an application of 1 to 1½ tons per acre during each rotation. The following mixture of seed will be sowed per acre: 4 pounds of alfalfa, 4 pounds of red clover, 2 pounds of alsike clover, and 4 pounds of timothy, the latter to be seeded in

the fall. Compared with alfalfa, an alfalfa-clover-timothy mixture usually produces a better stand and a larger amount of hay that is easier to cure. A mixture of legumes and grasses is also more effective than alfalfa alone in controlling erosion.

Table VII. Type of Hay on 42 Farms Little Mill Creek Watershed 1937(a)

Type	Per cent of total acres in hay
50% clover - 50% timothy	13
20% clover - 80% timothy	13
Alfalfa	2
Medium timothy	27
Poor timothy	35
Very poor timothy	8
Soybean	2
Total	100

(a) Data collected by Soil Conservation Service, Coshocton, Ohio.

Permanent Pasture Improvement Program. The permanent pastures have in general received no fertility treatment in the past except a small amount of manure in a few cases. The continual grazing of the permanent pastures without applying any lime and fertilizer to replace the elements removed has greatly reduced the carrying capacity. Over one-half of the permanent pasture in 1937 was classified as third grade and only 7 per cent was designated as excellent pasture, the latter being found in the creek valleys. The carrying capacities of the various grades of pasture shown in table VIII are roughly as follows: first grade, 1 to 2 acres per animal unit; second grade, 2 to 3 acres; third grade, 3 to 4 acres; fourth grade, 4 to 5 acres; and fifth grade, 5 to 10 acres per animal unit.

According to present recommendations the first grade pasture land will receive no lime or fertilizer because production is now at a high level. The fifth grade pasture land cannot be improved economically

Table VIII. Composition of Permanent Pastures on 42 Farms Little Mill Creek Watershed, 1937(a)

Classification	Per cent of total pasture
Grade 1, 70% - 100%, tame grasses and clover; growth medium to vigorous	7
Grade 2, 30% - 69%, tame grasses and clover; growth scant to medium	25
Grade 3, 10% - 29%, tame grasses and clover	52
Grade 4, 90% or more wild grasses and weeds; growth medium to vigorous	15
Grade 5, bracted plantain, poverty grass, etc.; growth scant	1
Total	100

(a) Data collected by Soil Conservation Service, Coshocton, Ohio.

under present conditions; consequently it will be reforested. The second, third, and fourth grade pastures will be improved by an initial application of approximately 2 tons of ground limestone and 400 pounds of either 20 per cent superphosphate or 0-14-6 fertilizer per acre. Subsequent treatments will include approximately 400 pounds of fertilizer and 1 ton of ground limestone per acre every fifth to sixth year.

Forest Improvement Program. In the past no planned forestry program has been followed with reference to the cutting of undesirable brush and trees, establishing new plantings, or protecting the woods from livestock. On many of the farms the practice has been to pasture the woodland adjoining a rotated field when the crop land was pastured. Table IX shows that in 1937 approximately 29 per cent of the total forest area was classified as having good protection from livestock and 30 per cent of the area was designated as "heavily pastured". Pasturing the woodland has destroyed many young trees, thus preventing the normal reproduction of the forest. Livestock pack the soil, destroy the foliage, and injure the roots, and thus make the trees more susceptible to the attacks of insects and diseases. Pasturing the woodland destroys the leaf litter which normally checks surface run off and thus reduces erosion.

Table IX. Forest Management on 42 Farms Little Mill Creek Watershed, 1937(a)

Type of Management	Per cent of total forest area
Good protection	29
Poor protection	22
Heavily pastured	29
Light pastured	20
Total	100

(a) Data collected by Soil Conservation Service, Coshocton, Ohio.

The forestry program recommended by the Soil Conservation Service includes the protection of the woodland area from livestock. In addition a forestry management program will be followed, and will consist of the cutting of undesirable trees and brush, planting trees where needed, protecting the trees from fire, and marketing the trees as they mature.

Probable Changes Induced by the New Farm Plans

Land Use. Table X shows the present and proposed changes in land use on 11 farms which were replanned by the Soil Conservation Service in 1938. Several other farms were replanned by this agency, however, these farms have not been used in the following discussion since they were not operated in the usual manner during the base years 1935 and 1937. The average amount of crop land on the 11 farms was 56 acres, of which 50 acres will be strip cropped and 2 acres will be contour tilled. Approximately 5½ acres of steep land will be reforested. To many local farmers strip cropping is a new practice; however, a recent study showed that a few farmers in Ohio, Pennsylvania, and West Virginia had been farming in this manner for a number of years.[1]

1 Morse, H. H. and Alger, H. B. A Study of Some of the Older Strip Cropping in Ohio, Pennsylvania, and West Virginia. U. S. Dept. of Agr., S. C. S., Mimeo. Bull., January 1939.

Table X. Present and Proposed Land Use on 11 Farms Replanned by the Soil Conservation Service, Little Mill Creek Watershed

(Average acreage per farm)

Land Use	Average 1935 and 1937		1943	
Corn	11.8		11.3	
Oats	5.7		1.3	
Wheat and rye	12.2		12.1	
Soybean hay	1.3		0.0	
Total depleting crops		31.0		24.7
Clover hay	7.0		0.0	
Clover-timothy hay	4.8		0.0	
Timothy hay and seed	13.4		0.0	
Alfalfa hay	1.4		3.7	
Alfalfa mixture hay	0.0		26.0	
Rotation pasture	6.2		5.6	
Idle land	1.8		0.0	
Total rotated area		65.6		60.0
Woods not pastured	7.6		24.7	
Woods pastured	16.7		0.0	
Permanent pasture	31.2		39.4	
Roads, buildings, waste	7.6		4.6	
Total farm area	128.7		128.7	

Under the proposed soil and water conservation program for the 11 farms approximately 4 per cent less of the average farm area will be in rotated crops. This reduction will result from converting some of the steeper and more severely eroded land to permanent pasture. On practically all of the farms, oats will be eliminated from the cropping plan making a five-year instead of a six-year rotation. The average acreage of depleting crops will be reduced from 31 acres to 24.7 acres by decreasing the acreage of oats and soybeans. An attempt will be made to change the type of hay from one that is predominantly timothy to an alfalfa-clover-timothy mixture. Under the proposed rotation, plowing will be done only for corn, whereas under the prevailing rotation the land was plowed for corn, oats, and wheat. From an erosion control standpoint less plowing will be a decided improvement.

Feed Production. Table XI shows the estimated average change in feed units on the 11 farms under the prevailing and proposed methods of farming. Calculated on the basis of average yields for the area a slight reduction in the number of feed units of grain will occur in the near future. However, as soil and water conservation practices are adopted it is reasonable to assume that grain yields per acre will increase as a result of water conservation, the increase in the fertility of the soil, and the conversion of the least productive crop land to permanent pasture. In that event, after a period of years has elapsed there should be no serious reduction in the amount of grain produced on these farms. However, this situation may not apply to the entire Mill Creek area. On a few farms that are now in a state of low productivity it will be necessary to decrease the acreage of depleting crops more than on the 11 farms shown. A discussion of this type of farm cannot be made at the present time because none of the operators have signed an agreement with the Soil Conservation Service and, therefore, no conservation plan has been made for any of these farms. From the standpoint of needed changes in land use the 11 farms may be considered as representative of the majority of the farms in the area. The estimated change in grain production ranged from a reduction in feed units of 15 per cent to an increase of 12 per cent, with an average decrease of 10 per cent for the entire group.

If all of the hay and pasture is improved according to the present plans, not only will the production be increased but the feed will be of higher quality. According to the estimates for the 11 farms, the increase in total feed units of hay and pasture ranged from 79 per cent to 163 per cent, with an average of 124 per cent for all farms. Under the prevailing methods of farming the total amount of feed units in hay and

Table XI. Estimated Change in Feed Units[a] on 11 Farms Under the Prevailing and Proposed Methods of Farming Little Mill Creek Watershed (Average production per farm)

Crop	Prevailing method	Proposed methods 5-10 years hence
Corn	413	395
Oats	71	16
Wheat	242	240
Hay	562	1225
Pasture	500	1153
Total	1788	3029

(a) A feed unit is equal to: 1 bu. corn, 2 bu. oats, .9 bu. wheat, .04 tons alfalfa hay, .05 tons mixed hay, .04 acres of rotation pasture or treated permanent pasture, or .09 acres of untreated permanent pasture.

pasture was estimated at 65 per cent compared with 78 per cent under the recommended methods of farming. Soil conservation methods offer the possibility of increasing the amount of feed produced on the farm. This is especially important on the small farm where it is often necessary to purchase additional feed.

Labor and Power Requirements. Table XII shows that according to the revised land-use plans, more labor and power will be used, assuming that no changes occur in the estimated amount of time applied per acre to the different crops. This additional labor and power will be used for harvesting the increased amount of hay under the new farm organization. The prevailing practice was to plow the ground each time for corn, oats, and wheat. By eliminating oats from the rotation only one plowing will be needed.

If unused family labor is available the additional labor demands may furnish a means of increasing the labor income from the farm. However, if additional labor is difficult to obtain an increase in the labor demands may not be advantageous to the farmer. Figure 1 shows that the labor will not be distributed as well under the new farm organization as it was under the prevailing methods. Under the revised farm plans two peak loads in

Table XII. Estimated Labor and Power[a] Applications for Crops Under the Present and Proposed Methods of Farming on 11 Farms, Little Mill Creek Watershed (Average number of hours per farm)

Crop	Prevailing methods		Proposed methods	
	Man	Horse	Man	Horse
Corn	437	590	418	565
Oats	85	143	19	32
Wheat and rye	163	265	139	218
Soybean hay	38	57	0	0
Alfalfa hay	25	35	67	92
Clover and timothy hay	202	253	0	0
Alfalfa mixture hay	0	0	468	650
Total	950	1343	1111	1557

(a) Labor and power estimates based on the following publication: Baker, R. H. - Labor Requirements for Crop Production in Ohio. Dept. of Rural Economics, Ohio State University, Mimeo. Bull. No. 115, September 1938.

labor will occur, one in June and July and the other in September, if all of the alfalfa hay mixture is harvested. The reduction in the acreage of oats will reduce the amount of labor needed in March, April and May.

Productivity Balance. On the 11 farms the calculated productivity balance on the rotated land ranged from -1.1 per cent to -.4 per cent under the prevailing farming methods compared with a range of -.1 per cent to +.1 per cent under the revised farm plans. The average for the group changed from -.7 per cent to zero. This means that under the prevailing methods of farming the productivity of the crop land was estimated to be declining at the rate of .7 per cent each year, while under the proposed farming methods a probable stabilization was indicated. This method of showing the rate of change in soil productivity was developed by the Ohio Agricultural Experiment Station and is calculated on the percentage of depleting and conserving crops in the rotation, fertility practices and erosion control.[1]

1 Salter, R. M., Lewis, R. D., and Slipher, J. A. Our Heritage, The Soil. Ohio State University, Extension Service Bulletin 175, 1936.

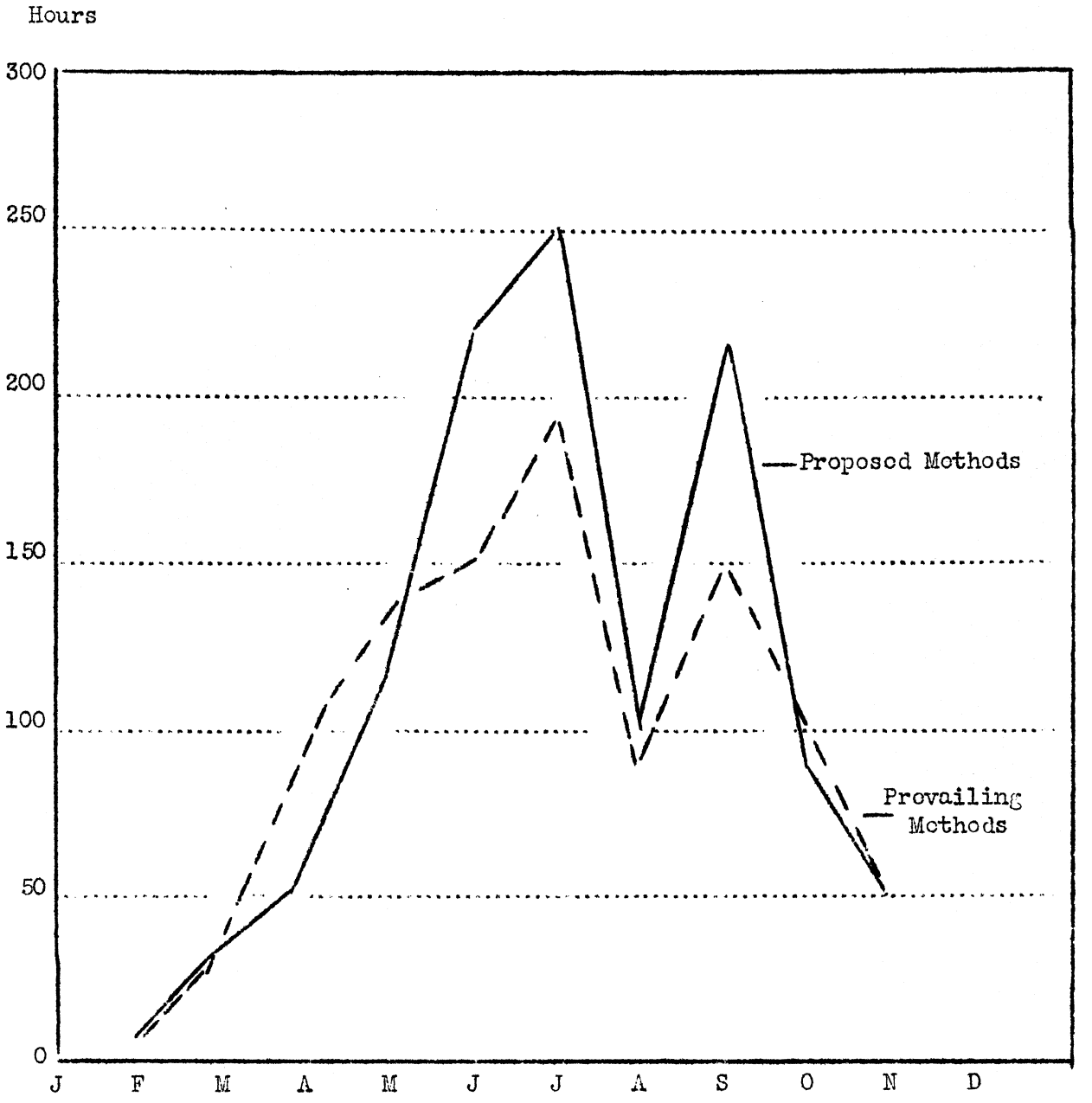

FIGURE I. Estimated Yearly Distribution of Labor per Farm on 11 Farms Under the Provailing and Proposed Methods of Farming, Little Mill Creek Watershed

Reference to table XIII shows that the greatest changes have occurred in the gain from conserving crops including hay and rotation pasture, and in the reduction of the soil losses from erosion. Productivity balance has been improved by increasing the amount and changing the type of hay, reducing erosion by strip-cropping and contour cultivation, and converting steep crop land to permanent pasture.

Table XIII. Calculated Change in Productivity Balance for the Prevailing and Proposed Methods of Farming for 11 Farms in Little Mill Creek Watershed

		Prevailing methods	Proposed methods
Gain from manure and fertilizer	points	15.	15.
Gain due to conserving crops	points	18.	34.
Loss due to erosion	points	36.	11.
Loss due to depleting crops	points	42.	36.
Productivity balance(a)	per cent	-.7	.0

(a) Net change in points divided by crop acres.

Case Studies of Some of the Probable Economic Effects of Adopting the Soil Conservation Program

To this point this report has been devoted to a description of the Little Mill Creek area, and the proposed soil conservation program for 11 farms. There still remain for discussion the economic and social implications of adopting the soil and water conservation practices previously described. A study of two of the eleven farms will serve to illustrate the expected costs and benefits from adopting the recommended practices. The two farms are in general representative of the farms in the area and will, therefore, depict how the program is planned to be put into operation. In addition these case studies will also emphasize the fact that changes will vary on different farms, although in general the recommendations may be the same.

Study of a 115-Acre Farm. Table XIV shows the proposed changes in land use on a 115-acre farm on which the following number of animal units[1] of livestock was kept in 1937: dairy cows, 8.0; other cattle, 1.5; horses, 2.0; sheep, 2.5; hogs, 1.0; and poultry .3. Practically all of the feed produced on this farm is fed to livestock. Oats and soybeans will be eliminated from the rotation since both of these crops are conducive to erosion. When oats follow corn in the rotation the soil is not protected during the winter months as is the case when corn is followed by wheat. The low

Table XIV. Prevailing and Proposed Land Use for a 115-Acre Farm, Little Mill Creek Watershed

Land Use	Av. 1935 and 1937	1938	1939	1940	1941	1942	1943
	Acres	Acres	Acres	Acres	Acres	Acres	Acres
Corn	11.0	11.5	11.9	13.7	9.7	9.3	12.0
Oats	2.0	3.0	8.1	0.0	0.0	0.0	0.0
Wheat	12.0	10.0	14.0	11.9	13.7	9.7	9.3
Soybean hay	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Depleting crops	27.0	24.5	34.0	25.6	23.4	19.0	21.3
Clover hay	8.0	14.0	10.0	0.0	0.0	0.0	0.0
Timothy hay	5.0	5.0	10.0	14.4	4.7	4.7	0.0
Alfalfa hay mixture	0.0	0.0	0.0	14.0	25.9	30.3	32.7
Conserving crops	13.0	19.0	20.0	28.4	30.6	35.0	32.7
Rotated area	40.0	43.5	54.0	54.0	54.0	54.0	54.0
Woods	12.0	12.0	17.0	17.0	17.0	17.0	17.0
Permanent pasture	56.0	52.5	40.0	40.0	40.0	40.0	40.0
Roads, bldgs., waste	7.0	7.0	4.0	4.0	4.0	4.0	4.0
Total farm area	115.0	115.0	115.0	115.0	115.0	115.0	115.0

yield of oats and the substitution of legume hay for soybean hay make this shift in land use possible. During the period of reorganization the acreage of the various crops may fluctuate as a result of changing the fields in a manner that will least disturb the present farm operations. After the new program is in full operation the acreage of corn and wheat may change

1 An animal unit is equal to: 1 horse, 1 cow, 2 head of young cattle, 10 ewes, 20 lambs, 3 brood sows, 1400 lb. gain in hogs, or 100 chickens.

somewhat from year to year due to the different size of the three strip-cropped fields. According to the conservation plans all of the crop land will be contour strip-cropped except 5 acres of bottom land. The strips will be 70 feet wide with a strip of hay between two strips of grain.

The crop land will receive an initial treatment of 3 3/4 tons of ground limestone per acre applied to the wheat ground before seeding. Subsequent applications of lime probably will be about 2 tons per acre applied once during the rotation. The large application of lime will be made for the purpose of establishing an alfalfa-clover-timothy hay mixture. The initial permanent pasture treatment will include 2 3/4 tons of ground limestone and 400 pounds per acre of 20 per cent superphosphate fertilizer. Subsequent treatments should require approximately 1 ton of ground limestone and 400 pounds of fertilizer per acre applied once every fifth to sixth year. The forestry improvement program will include protecting the woods from livestock, cutting undesirable trees and brush, and planting approximately 6500 trees. Under the revised farm organization 40 acres of permanent pasture and 33 acres of hay have been planned for 1943. Unless a portion of the hay is used for rotation pasture, it will probably be necessary to increase the acreage of permanent pasture.

An "advance estimate" of the market value of the crops and the additional expenses of adopting the recommended conservation practices on the 115-acre farm is shown in table XV. In this table the calculations were based on a 10-year average of farm prices and crop yields for the area since the crop yields on this farm approximate the average yields for the area. The same crop yields per acre were assumed throughout the entire period. This assumption may be somewhat conservative because crop yields may be expected to increase slightly the first year because of

water conservation, and at the beginning of the second rotation from the plowing under of larger crop residues. The additional man and horse hours have been figured at 25 cents and 12½ cents per hour respectively.[1]

Table XV. Estimated Market Value of Crops[a] Under the Proposed and Prevailing Methods of Farming on a 115-Acre Farm, Little Mill Creek Watershed

(expressed in dollars)

	Av. 1935 and 1937	1938	1939	1940	1941	1942	1943
Estimated value of crops	718[b]	747[c]	837	1027	1169	1157	1163
Additional expenses:							
Lime and fertilizer	0	314	312	146	80	40	40
Labor and power	0	0	71	113	117	120	160
Yearly value of crops minus additional expenses	718[b]	433[c]	454	768	972	997	963
Cumulative value of crops minus additional expenses	718[b]	1151[c]	1605	2373	3345	4342	5305
Cumulative value of crops under prevailing methods of farming(d)	718	1436	2154	2872	3590	4308	5026

(a) Prices used: corn, $.60 bu.; oats, $.35 bu.; wheat, $.85 bu.; hay, $9.00 ton; alfalfa hay mixture, $10.00 ton; pasture, $.20 per feed unit. Yields per acre used: corn, 35 bu.; oats, 25 bu.; wheat, 18 bu.; hay, 1.0 ton; alfalfa mixture, 1st and 2nd year, 2.0 tons, 3rd year, 1.5 tons; untreated permanent pasture, 1100 lbs.; treated permanent and rotation pasture, 2500 lbs. dry matter.

(b) Prevailing methods of farming.

(c) 1938-43 proposed methods of farming.

(d) It is assumed that the market value of the crops under the prevailing methods of farming would be $718 for each year during the period 1937-43. The figure $2154 for 1939 represents the sum of $718 for 1937, $718 for 1938 and $718 for 1939.

The "advance estimate" in table XV shows that the cumulative net market value of the crops under the prevailing and proposed methods of

1 The assumption is made that the additional labor and power will represent a cash increase in operating expenses because this operator is at the margin of surplus labor and power. On farms with surplus labor and power no additional cash outlay will be required for these items since the current labor and power will be more fully utilized.

farming will be approximately equal in 1942. However, during the years 1938-41 the estimated cumulative market value of the crops will be greater under the prevailing than under the proposed methods of farming. This is due to the large applications of lime and fertilizer which represent in 1938 and 1939 slightly more than one-third of the labor income from this farm. Since the complete benefits from lime and fertilizer are not realized immediately after application, cash outlays for these materials cannot be recovered for several years. The large expenditures in 1938 and 1939 were made for the purpose of improving the farm as rapidly as possible for demonstrational purposes. In most cases the farmer should find it most convenient from the standpoint of cash outlay, labor requirements, and the amount of feed produced to spend approximately the same amount for lime and fertilizer each year. This would tend to disturb least the present farm organization and would give the farmer an opportunity to adjust the livestock production with reference to the revised cropping plans.

The estimates on the 115-acre farm are probably too simplified because the effects of adopting many of the soil conservation practices are cumulative up to a certain point. As the program is put into operation and larger crop residues are plowed under, crop yields should increase. Thus, more livestock may be kept and more manure should be available for further improving the productivity of the soil. On the other hand, less limestone will be required in the second and succeeding rotations than the amount needed for the initial application.

Study of an 80-Acre Farm. Table XVI shows the proposed changes in land use on an 80-acre farm on which the following animal units of livestock were kept in 1937: dairy cows, 6.0; other cattle, 1.0; horses, 2.5; sheep, 1.0; hogs, .5; and poultry, 1.0. The rotated area has been

slightly decreased by converting some of the crop land to permanent pasture. Oats have been eliminated from the rotation. The acreage of corn and wheat will fluctuate somewhat from year to year due to the different size strips and the practice of raising wheat, but not corn, on the correction strips. The acreage of hay will be increased from 17 acres to 25 acres, provided all of the hay is harvested.

Table XVI. Prevailing and Proposed Land Use for an 80-Acre Farm, Little Mill Creek Watershed

Land Use	Av. 1935 and 1937	1938	1939	1940	1941	1942	1943
	Acres	Acres	Acres	Acres	Acres	Acres	Acres
Corn	10.0	8.0	9.9	10.3	9.8	8.5	10.9
Oats	7.0	4.0	0.0	0.0	0.0	0.0	0.0
Wheat	9.5	10.5	8.2	9.9	14.3	11.8	8.5
Soybean hay	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Depleting crops	28.5	22.5	18.1	20.2	24.1	20.3	19.4
Timothy hay	3.0	10.0	16.9	17.1	3.3	0.0	0.0
Clover-timothy hay	12.0	0.0	0.0	0.0	0.0	0.0	0.0
Clover hay	0.0	9.0	10.5	0.0	0.0	0.0	0.0
Alfalfa hay mixture	0.0	0.0	0.0	8.2	18.1	25.2	26.1
Rotation pasture	4.5	4.0	0.0	0.0	0.0	0.0	0.0
Conserving crops	19.5	23.0	27.4	25.3	21.4	25.2	26.1
Rotated area	48.0	45.5	45.5	45.5	45.5	45.5	45.5
Woods	10.0	10.0	7.0	7.0	7.0	7.0	7.0
Permanent pasture	17.0	19.5	22.5	22.5	22.5	22.5	22.5
Roads, bldgs., waste	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total farm area	80.0	80.0	80.0	80.0	80.0	80.0	80.0

The entire rotated area will be contour strip-cropped in strips 70 feet wide. The crop land will receive an initial application of $2\frac{1}{4}$ tons of ground limestone per acre for the purpose of establishing an alfalfa-clover-timothy hay mixture. The alfalfa and clover will be seeded in the wheat early in the spring. The timothy will be seeded in the fall when the wheat is sowed. The permanent pasture will receive an initial application of 2 tons of ground limestone and 400 pounds per acre of 20 per cent superphosphate fertilizer. Subsequent permanent pasture treatment will

probably require 1 ton of ground limestone and 400 pounds of fertilizer per acre, once every fifth to sixth year. Approximately 3200 trees will be planted and a timber stand improvement program will be followed. The forest will be protected from livestock, and undesirable brush and trees will be cut. The clearing of several acres of brush land will decrease the area classified as woods.

Table XVII. Estimated Market Value of Crops[a] Under the Proposed and Prevailing Methods of Farming on an 80-Acre Farm Little Mill Creek Watershed (expressed in dollars)

	Av. 1935 and 1937	1938	1939	1940	1941	1942	1943
Estimated value of crops	631[b]	588[c]	616	735	909	965	993
Additional expenses:							
Lime and fertilizer	0	35	161	186	50	50	50
Labor and power	0	0	0	0	31	38	62
Yearly value of crops minus additional expenses	631[b]	553[c]	455	549	828	877	881
Cumulative value of crops minus additional expenses	631[b]	1184[c]	1639	2188	3016	3893	4774
Cumulative value of crops under prevailing methods of farming(d)	631	1262	1893	2524	3155	3786	4417

(a) Prices used: corn, $.60 per bu.; oats, $.35 bu.; wheat, $.85 bu.; hay, $9.00 ton; alfalfa hay mixture, $10.00 ton; pasture, $.20 per feed unit. Yields per acre used 1935-43: corn, 35 bu.; oats, 25 bu.; wheat, 18 bu.; hay, 1.0 ton; alfalfa hay mixture, 1st and 2nd years, 2.0 tons, 3rd year, 1.5 tons; untreated permanent pasture, 1100 lbs.; treated permanent and rotation pasture, 2500 lbs. dry matter.
(b) Prevailing methods of farming.
(c) 1938-43 proposed methods of farming.
(d) It is assumed that the market value of the crops under the prevailing methods of farming would be $631 for each year during the period 1937-43. The figure $1893 represents the sum of $631 for 1937, $631 for 1938 and $631 for 1939.

In table XVII it is estimated that all of the additional expenses for soil conservation will not be recovered until 1942. At that time the

cumulated net market value of the crops produced under the proposed plans have been estimated to slightly exceed the cumulated market value of the crops produced under prevailing practices. This does not mean that the recommended conservation practices are unprofitable because complete results are not realized immediately. It does illustrate, however, that the additional expenses may exceed the additional returns for a short period of time, the amount depending upon the expenditure for conservation practices. The plans for both the 80-acre and the 115 acre farms are similar in that improvement will be made as rapidly as possible. Thus, the expenditure for lime and fertilizer will be greatest during the first three years of the adoption of the conservation practices. A small amount of additional labor and power will be needed on the 80-acre farm, however, the operator should be able to meet this additional requirement with his present labor and power supply. In order to be conservative the additional labor and power has been treated as a cash expense on the 80-acre farm because in some cases it may represent an additional cash outlay for the farmer. The expenditure for lime and fertilizer in 1938 and 1939 is equivalent to one-fourth of the annual farm income. The change in feed units and the amount and distribution of labor for the 80-acre and the 115-acre farms will follow the same trends as shown for the 11 farms in tables XI and XII and figure 1.

The preceding case studies represent in a general way the majority of the farms in the Little Mill Creek area. They do not represent a small number of the farms on which a large proportion of the crop land should be converted to permanent pasture. Since plans have not been made at the present time for improving these farms, no discussion of this group can be given in this report. The "advance estimates" on the two

farms indicate that the additional market value of the crops should exceed the increased expenses in adopting the recommended conservation practices. Practically all of the additional expense will be for the improvement of the meadows and permanent pasture, practices which have been recommended as profitable by agricultural experiment stations. In general no additional fences will be required, and the buildings will be adequate for the recommended farming practices.

Since the farmers in the Little Mill Creek area receive practically all of their income from the sale of livestock, the possibility of the disposition of the crops through livestock should be considered. By following the recommended soil conservation program more feed probably will be produced, and if the additional feed can be used profitably in feeding livestock, the farm income should be higher than the additional market value of the crops above the additional expenses. In making an "advance estimate" of the economic benefits from feeding the additional crops, such factors as the efficiency of the livestock, the amount of farm labor available, the adequacy of the farm buildings, and the available markets should be considered. If the present type of livestock is unprofitable it would not be good farm management to increase livestock numbers unless profitable animals could be secured. On many farms a larger income may be obtained by increasing the efficiency of the livestock instead of increasing the volume of business with unprofitable animals. Thus, under a system of poor livestock management the entire economic gains from adopting soil conservation practices may be lost. On the small farm where excess labor and power is available, the adoption of the recommended conservation program will offer a means of using this resource more fully.

In evaluating the economic effects of adopting the soil conservation program not only should the effects on the individual farmer be considered, but also the effects on all of the farmers, as a whole. The preparation of "advance estimates" on individual farms where an increase in hay and livestock production is recommended may be valid from the individual point of view; but may be questioned as to the results if all farmers increased production. The utilization of larger hay crops may not be the feeding of more livestock for all farmers. It may mean that some of the hay should be plowed under, thus reducing the amount of fertilizer required, or in other cases retiring some of the marginal crop land to pasture. Soil conservation should be considered as an efficient aid in crop production, and is, therefore, just as important as efficient livestock management. The two factors should go together in contributing toward the most efficient farm organization.

How Soil Conservation Practices May Affect the Farm Family

In the final analysis soil conservation practices are recommended as a means of improving the economic status of both the farmer and society in general. If many of the present farms are to be maintained as producing units it is essential that soil conservation practices should be followed. This is especially true on the farms where the present volume of business is now so small that the operator cannot obtain a satisfactory labor income. If soil depleting practices are followed, crop yields, livestock production, farm income and land values will eventually decline. Decreased incomes lower the level of living of the farm family, and reduced land values reduce the market value of the farm assets. This situation often leads to the abandonment of the land, thus creating new

problems for the people who remain in the community. The maintenance of the schools, churches, and community organizations becomes a greater problem when some of the farm families leave the community.

Over a long period of time it is impossible to view the farm as a means of support for the operator and his family unless proper soil conservation practices are followed. Soil depletion tends to increase the cost of agricultural production, and thus represents a real cost to both the farmer and society. The objective of the soil conservation program is to improve the present and future welfare of the people by establishing a permanent type of agriculture.

Difficulties in Adopting Soil Conservation Practices

Although the adoption of soil conservation practices may be profitable for the farmer over a period of years, he may hesitate to change his farming operations for several reasons. He may not have sufficient capital to make the additional cash outlay for lime, fertilizer, new fences, and in some cases for farm buildings and machinery. According to the "advance estimates" in this report four to five years will be required in many cases before the additional cash outlay for lime and fertilizer will be recovered in the increased farm income as a result of following the recommended conservation practices. In general, the amount of fence required under the prevailing and proposed farming methods will remain practically the same for the farms in the Little Mill Creek area. In rearranging the fields to conform to the revised farm plans new fences will often be required because some loss always occurs when fences are moved. On a few farms additional building space may be required for storing the additional hay and housing more livestock. For the farmer

who has a sufficient reserve of operating capital, the increased expenses for soil conservation may not represent a serious problem. However, such expenses may delay, or even make impossible, the adoption of conservation practices by the farmer who is in debt. In some cases a farmer may prefer to spend his present income for home conveniences, education, or other desirable goods and services, rather than farm improvement which will increase his future income.

The question arises as to how a farmer with only a small amount of extra operating capital may adopt some of the recommended soil and water conservation practices over a period of years. Perhaps this can be done best by improving the hay and permanent pasture first, and then reducing the grain crops to the point necessary to control erosion. This procedure may not be the ideal from the standpoint of conservation, since all necessary changes should be made as rapidly as is physically possible. However, it does suggest a method whereby a farmer with limited financial means may eventually adopt a number of the recommended conservation practices which he would not have adopted otherwise.

In many cases the farmer may not be able to replan his farm with reference to soil conservation without the assistance of some outside agency. If the benefits from some of the conservation practices are to be fully realized, the farmer must take every precaution in putting the practices into operation. For example, if the field strips deviate considerably from the contour, erosion may be greater than would be the case if the field were farmed in one crop. It is, therefore, evident that a certain amount of knowledge of conservation practices is essential if the program is to be successful.

The adoption of soil conservation practices may be difficult on a farm operated by a tenant. The landlord may not realize the need of soil conservation, and the tenant may be interested in following a "mining" type of agriculture. Since most farm leases are made for only one year, a tenant will hesitate to make long-time improvements such as liming, strip cropping, and terracing unless he is reasonably sure that he will be compensated for them. Longer leases would, therefore, encourage the tenant to follow long-time conservation practices.

On farms where a large reduction in the acreage of grain crops must be made for conservation purposes the farmer may find that less grain-consuming and more hay-consuming animals should be raised. If the farmer is interested in raising hogs, he may object to shifting from the production of hogs to cattle, but such a shift may be advisable if the soil conservation program is to be followed.

Some farmers may object to changing their present farm practices because they plan to retire from farming in a few years. Others hesitate to change practices that they have followed for a number of years because of inertia and custom. In the final analysis the adoption of soil conservation practices will depend upon the farmer's attitude toward the program as well as his available resources.

Summary

In this report some of the economic and social implications of the adoption of a soil and water conservation program in the Little Mill Creek area have been discussed. The recommended conservation practices include: (1) proper land use; (2) application of lime and fertilizer; (3) elimination of oats and soybeans from the rotation; (4) strip cropping

and contour cultivation on sloping land; (5) improvement of the type of hay and also the permanent pasture; and (6) reforestation of steep and severely eroded land.

According to "advance estimates" based on present research material, it is indicated that feed units of grain will be slightly reduced, unless grain yields per acre increase, and that feed units of hay and pasture will be approximately doubled under the new farm plans. More labor and power probably will be needed for harvesting the additional hay. On many of the farms four to five years probably will be required before the additional expenses of adopting the recommended soil and water conservation practices will be completely recovered. Even though a complete conservation program cannot be followed, the adoption of some of the recommended conservation practices should be profitable over a period of time.